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LUMINARY Memo #67

To: Distribution
From: C. W. Schulenberg
Date: 17 February 1969
Subject: LUMINARY Revisions 70 - 79

Major Changes Incorporated into Revision 71

Note: Revision 70 was identical to the released program, Revision 69.

- 1) PCR 698 was implemented. (Add LM Position Determination Capability to P57)
- 2) PCR 699 was implemented. (Pad Load AOT Back Detent AZ and EL angles) This change requires that six additional single-precision parameters be padloaded: AOTAZ +3, +4, +5, and AOTEL +3, +4, +5.
- 3) The intermediate restart points were removed from the ascent guidance equations in order to reduce computer execution time during P12, P70 and P71.
- 4) LUMINARY anomaly LNY-30 was fixed by initializing VSELECT to zero at SETPOS1.
- 5) LUMINARY anomaly LNY-27 was fixed.
- 6) LUMINARY anomaly LNY-25 was fixed by adding code to the Verb 37 logic to reset MUNFLAG whenever a new program is selected.
- 7) LUMINARY anomaly LNY-23 was fixed.
- 8) LUMINARY anomaly LNY-21 was fixed.
- 9) LUMINARY anomaly LNY-24 was fixed.
- 10) PCR 659.2 was implemented. (Suppression of X-MODULO ing in KEPLER.
- 11) The flagbit FLZONEO was deleted since it was no longer being used (PCR 259).

Major Changes Incorporated into Revision 72

- 1) PCR 700 was implemented. (Improve the Rate of Descent Mode (P66) Performance). This change requires that two new parameters be padloaded: RODSCALE (amount of velocity change per "click" of ROD switch) and TAUROD (time constant for velocity-error nulling).
- 2) PCR 260 was implemented. (Preferred Orientation During LM Aborts). This change requires that two new parameters be padloaded: COSTHET1 and COSTHET2.
- 3) Two new flagbits were defined: RODFLAG and ROTFLAG. RODFLAG is used to provide restartability for P66 (PCR 700). The flag is set when P66 is initiated and reset by the restart routine. A restart which occurs when P66 is in operation will cause P66 to re-initialize and continue. ROTFLAG is used to control the preferred orientation logic in the ascent guidance (PCR 260).
- 4) Redundant coding was deleted from the ascent guidance equations in order to further reduce execution time during P12, P70, and P71. The guidance had been recomputing several parameters that were already available from Servicer.
- 5) The flagbit 2PHASFLG was deleted since it was no longer being used (PCR 670).
- 6) PCR 670 was implemented. (Simplification of Landing Programs)
- 7) LUMINARY anomaly LNY-20 was fixed.
- 8) PCR 721 was implemented. (Time-Theta and Time-Radius Alarm Abort). This change added the new POODOO code 607.

Major Changes Incorporated into Revision 73

- 1) PCR 717 was implemented. (DAP Bias Acceleration Initialization). This change requires that two single-precision parameters be padloaded for P12: IGNAOSQ and IGNAOSR.

Major Changes Incorporated into Revision 74

- 1) LUMINARY anomaly LNY-26 was fixed.
- 2) LUMINARY anomaly LNY-36 was fixed.
- 3) LUMINARY anomaly LNY-28 was fixed.

- 4) The erasables XMODULO and TMODULO were deleted since they were no longer being used (PCR 659. 2). The erasables APO and JLING were also deleted (PCR 708 and PCR 670).
- 5) LUMINARY anomaly LNY-33 was fixed. This change requires two new parameters to be padloaded for P65: V2FG (a vector), and TAUVERT (the time-constant for P65).
- 6) The flagbit POUTFLAG was deleted since it was no longer being used (PCR 670).
- 7) PCR 270 was implemented. (Placement of desired insertion radial velocity component into erasable for P70/P71/P12). This change requires that a new parameter be padloaded for P70 and P71: ABTRDOT.
- 8) PCR 648 was implemented. (Modify P42 to permit staging between TIG-30 and TIG.)
- 9) P66 was further modified so that all three components of noun 63 are updated at one second intervals. In addition, bypasses were added around all unnecessary coding (coding relevant only to the automatic landing programs) so that computer execution time during both P66 and P67 was reduced to the minimum.
- 10) LUMINARY anomaly LNY-34 was fixed. This change requires that a new parameter be padloaded for P64: DELTTFAP.
- 11) Noun 76 was changed to reflect the requirements of PCR 708.
- 12) PCR 697 was implemented. (Limitation of LM abort orbit insertion to 1/2 degree plane change). This change requires that a new parameter be padloaded for P70 and P71: YLIM.
- 13) PCR 708 was implemented. (Provide continuously variable abort orbit insertion targetting). This change requires that nine new parameters be padloaded for P70 and P71: VMIN and ABTCOF through ABTCOF +15D.
- 14) PCR 709 was implemented. (Improve TGO prediction for short burns in the BURNTIME routine).

Major Changes Incorporated into Revision 76

Note: Revision 76 was made to correct serious assembly problems in Revision 75.

- 1) The erasable ACG was deleted since it was no longer being used (PCR 670).

- 2) PCR 731 was implemented. (Modify the Lunar Landing Guidance Equations to Compensate for Computation, Throttle, FINDCDUW, and Altitude Control Lags). This change requires that a new parameter be padloaded for P63 and P64: LEADTIME.
- 3) PCR 688 was implemented. (Guidance Frame Erection Check). This change requires that four new parameters be padloaded for P63 and P64: TCGIBRAK, TCGFBRAK, TCGIAPPR, and TCGFAPPR.
- 4) PCR 654 was implemented. (Lessen delays in R31).
- 5) The correction to LUMINARY anomaly LNY-24 was completed.
- 6) PCR 696 was implemented. (V06N22 Display in P57).

Major Changes Incorporated into Revision 77

- 1) A program error was corrected in the POODOO routine that would have caused the computer to function anomalously in the event that a 1501 abort occurred while Servicer was running.

Major Changes Incorporated into Revision 79

Note: Revision 79 was made to correct cusses in Revision 77 and Revision 78.

- 1) PCR 701 was implemented. (LM/CSM DAP Control Law Modification).
- 2) PCR 719 was implemented. (Speed up P21). A new flagbit, P21FLAG, was defined for use by the modified P21.
- 3) PCR 695 was implemented. (Provide option for CSI Program to Compute T(APOAPSIS)).
- 4) PCR 720 was implemented. (Abort coasting integration when in infinite acceleration overflow loop). This change added the new POODOO code 430.
- 5) The implementation of PCR 648 was corrected.